Growth, Feed Conversion Efficiency and Carcass Characteristics of Malpura and Malpura × Awassi Crossbred Lambs in a Hot Semi Arid Environment

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ABSTRACT : The growth rate, feed conversion efficiency and carcass characteristics of nine native Malpura (M) and eight Awassi × Malpura half bred (AM) male lambs were compared under intensive feeding on 60:40 concentrate and roughage based composite feed. Weaning body weight was similar in the two genetic groups while finishing body weight, total body weight gain and average daily gain during the experiment were higher ($p<0.01$) in AM than M lambs. The feed conversion efficiency was lower in M than AM lambs with 15.7 and 19.8 per cent feed conversion efficiency, respectively, in the two genetic groups. The dressing yield in terms of preslaughter weight or empty live weight was however similar in the two genetic groups. The loin eye area was also greater ($p<0.01$) in AM than M lambs. The cutability was similar for the two groups amounting to 33.2, 13.3, 13.2, 23.3 and 16.6% of half carcass, respectively, for leg, loin, rack, neck and shoulder and breast and foreshank. On an average the separable lean, fat and KOH bone content of the half carcass were 48.3, 16.8 and 23.3% for native M and 54.1, 15.0 and 19.0% for AM lambs, respectively. It is concluded that growth rate and feed conversion efficiency were better in Awassi × Malpura half bred than native Malpura lambs while dressing yield and cutability of standard cuts were similar in the two genetic groups. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 3 : 377-381)***

Key Words : Carcass Characteristics, Hot Environment, Intensive Feeding, Lambs

INTRODUCTION

The native sheep maintained by the farmers under mixed grazing with other livestock species on community grazing land in the western major sheep-producing zone of India attain 16 kg body weight with an average daily gain (ADG) of 50 g/day at 6 months of age (Kaushish et al., 1990). The farmers usually sell off their finisher lambs for slaughter around 9-12 months of age weighing about 20-22 kg with an average carcass weight of 10 kg (Karim, 2000). Improvement in lower growth rate and carcass yield of native sheep in hot semiarid environment were attempted by cross breeding them with established mutton breeds (Dorset/Suffolk) imported from UK. The evolved crossbred lambs were able to attain 35 kg finishing weight at 6 months of age under intensive feeding on 50:50 roughage and concentrate based complete feed (Karim and Rawat, 1996). Subsequent studies indicated that the improved growth rate of the crossbred lambs in individual feeding was not reflected in herd production due to lower reproductive efficiency of the crossbred population under hot semiarid environment (CSWRI, 1992). This response was ascribed to poor adaptability of the crossbred to prevailing hot environmental conditions of the location (Sehgal et al., 1982; Singh et al., 1982; Karim, 2000). Therefore Awassi, a relatively heavy sheep from Middle East reared under environmental conditions similar to this location was imported to improve the growth rate of native sheep. The growth rate and carcass characteristics of Awassi crosses with native Malpura needed to be evaluated under controlled feeding management.

The reported study was therefore conducted to compare growth rate and carcass characteristics of native Malpura and their half bred with Awassi under intensive feeding on 60:40 concentrate and roughage based composite feed.

MATERIALS AND METHODS

Site of the experiment

The experiment was conducted at the Central Sheep and Wool Research Institute, Avikanagar, India, a hot semiarid location at 75° 22′E latitude and 27° 17′N longitude and 320 m above mean sea level. The study was initiated during the middle of April and continued till the middle of June, considered peak summer months in this part of the country. During the experiment the mean minimum and maximum temperature and relative humidity (RH) of the location ranged from 24.6-27.0°, 41.4-49.6°C and 18.4 and 38.3%, respectively.

Experimental animal and diets

Nine Malpura (M) and eight Awassi×Malpura half bred (AM) male weaner (90 days old) lambs were obtained from the Institutional flock for the experiment. The lambs were dewormed before initiation of the study with Nilverm® and vaccinated against Enterotoxaemia and Sheep pox. Lambs were fed a composite feed containing 40% pala (*Zizyphus nummularia*) leaves, 30% barley grain, 17% damaged wheat, 11% groundnut cake, 1% mineral mixture, 1% common salt and 20 g vitamin premix (Vitablend®) per 100 kg of feed mixture. The chemical composition (AOAC,

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Received May 18, 2001; Accepted October 26, 2001

1984) of the composite feed and pala (*Ziziphus nummularia*) were 83.2 and 84.7% organic matter (OM), 13.3 and 10.6% crude protein (CP), 55.9 and 57.9% nitrogen free extract (NFE) and 13.6 and 14.0% crude fibre (CF), respectively.

Feeding management

All the lambs were assigned to the experiment as and when they were 90 days old. The lambs were maintained throughout the experiment in individual chain link fencing enclosures in a open-sided asbestos-roofed animal shed. *Ad libitum* feed was offered daily in the morning at 08:00 h after quantifying and discarding the residue of the previous day. They were offered free choice clean drinking water once daily at 14:30 h in their respective enclosures. The lambs were weighed at weekly intervals on a platform balance. The growth study was continued for 90 days.

Slaughter protocol

All the lambs were slaughter at the fixed age of 180 days. The lambs were fasted for 18 h with free access to water and slaughtered in an experimental abattoir by the Halal method. In Halal method, the conscious animals are placed in lateral recumbency with head facing upwards. Bleeding was carried out by an incision on the Jugular furrow at the occipito-atlantal junction close to head, severing both carotid arteries, Jugular veins and in some cases the trachea, oesophagus and spinal cord. Immediately after slaughter the head was removed at the atlanto-occipital joint and fore and hind feet at the carpal and tarsal joints, respectively. The head was removed and carcass was partially skinned on the floor and then hanged in the racks by hind legs and skinning was completed. Immediately after skinning evisceration was carried out and the carcass and non carcass components were weighed. Hot carcass weight included kidney and kidney fat, and total edible offal comprised of testes, spleen, pancreas, caul fat, kidney fat, kidney, liver and heart. Lungs, trachea and heart were weighed as one piece and designated as pluck. Total inedible offal constituted blood, lungs, intestine, head and hooves. Loin eye area (cm^2) was recorded on the cut surface of *Longissimus dorsi* muscle at the interface of 12th and 13th ribs on both the sides of the carcass. The carcass was then split along the mid line and left half was cut into leg, loin, rack, neck and shoulder and breast and fore shank as per ISI (1963) specifications. The per cent composition of the cuts was calculated as proportion of chilled half carcass weight. The next day various cuts stored under ice were manually dissected into lean, fat and bone. The dissected bones from the standard cuts were then boiled separately for one hour in 2% KOH and KOH bone weight was recorded (ISI, 1963).

Chemical analysis

Milled (2 mm screen) samples of feed offered were subjected to chemical analysis (AOAC, 1984) while CP was estimated by Micro Kjeldahl method.

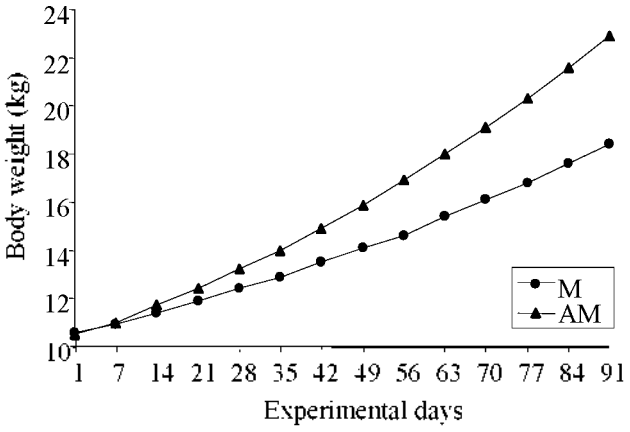
Statistical analysis

The generated data on feed intake, feed conversion efficiency and carcass characteristics were subjected to analysis of variance using the SPSS-10 package on a Pentium III computer. The growth pattern of individual lamb was charted by polynomial regression with quadratic component and the generated constants were subjected to analysis of variance to assess the group differences. The pooled constants of the two genetic groups are presented graphically (figure 1).

RESULTS AND DISCUSSION

On average the lambs consumed 66.8 and 77.9 g dry matter (DM), 7.8 and 7.1 g digestible crude protein and 54.5 and 49.8 g total digestible nutrients (TDN)/kg $W^{0.75}$/d for average daily gain of 79.4 and 125.5 g in native Malpura and Awassi × Malpura weaner lambs, respectively (Unpublished data). The nutrient intake of the weaner lambs was adequate for meeting the growth requirement (ICAR, 1985).

Weaning body weight was similar in the two genetic groups (11.1 kg) while the final body weight after 90 days of intensive feeding was significantly ($p<0.01$) higher in crossbred AM (22.6 kg) than native M (18.2 kg) lambs. Like wise total body weight gain in the experiment and average daily gain were also higher in AM than M lambs (table 1). The AM showed better weight gain than M lambs



M: $Y_1=10.51+0.059X_1+0.0003X_1^2$ ($R_1^2=0.96$)
AM: $Y_2=10.38+0.083X_2+0.0006X_2^2$ ($R_2^2=0.98$)

Figure 1. Growth performance of Malpura and Awassi×Malpura crossbred weaner lambs

Table 1. Growth performance, feed conversion efficiency and carcass traits of Malpura (M) and Awassi × Malpura (AM) weaner lambs

Attributes	M	AM	Average	SEM	Level of significance
Number of experimental lambs	9	8	-	-	-
Initial body weight (kg)	11.0	11.2	11.1	0.28	p>0.05
Finishing body weight (kg)	18.2	22.6	20.4	0.58	p<0.01
Total body weight gain (kg)	7.2	11.3	9.3	0.82	p<0.01
Average daily gain (g)	79.4	125.5	102.5	9.11	p<0.01
Total dry matter intake (kg)	45.4	58.1	51.8	4.13	p<0.01
Dry matter intake (kg)/kg body weight gain	6.3	5.1	5.7	0.31	p<0.01
Dry matter intake (g/kg body weight/d)	34.2	38.6	36.4	5.13	p>0.05
Dry matter intake (g/kgW $^{0.75}$/d)	66.8	77.9	72.4	8.13	p>0.05
Carcass traits					
Preslaughter weight (kg)	16.0	20.4	18.2	0.31	p<0.01
Empty live weight (kg)	14.6	18.2	16.4	0.71	p<0.01
Hot carcass weight (kg)	8.1	9.9	9.0	0.35	p<0.01
Dressing % on live weight	50.5	48.9	49.7	0.89	p>0.05
Dressing % on empty live weight	55.3	54.4	54.9	0.51	p>0.05
Loin eye area (cm^2)	8.8	10.3	9.6	0.36	p<0.01
Total edible offal (kg)	8.5	10.4	9.5	0.55	p<0.01
Total inedible offal weight (kg)	5.6	7.2	6.4	0.28	p<0.01
Caul and kidney fat weight (g)	347.4	396.2	371.8	30.35	p>0.05

during the experiment (figure 1). Both M and AM lambs showed progressive gain in body weight over the experimental period while the rate of gain was better ($p< 0.01$) in crossbred AM than native M lambs. Better body weight gain of AM lambs was possibly due to their higher genetic potential (Bohra, 1984). Daily dry matter intake (DMI) as well as total DMI during the experiment was higher ($p<0.01$) in AM than M lambs while on conversion of the DMI in terms of unit body weight or metabolic body size, the DMI was found to be similar in the two genetic groups. The feed conversion ratio was higher in native M than crossbred AM with 15.7 and 19.8% feed conversion efficiency, respectively in the two genetic groups. The average 16% feed conversion efficiency of the M lambs observed in this study was similar to earlier reports (Arora and Karim, 1995; Karim and Rawat, 1996). The observed higher feed conversion efficiency of crossbred AM (20%) was possibly due to better feed conversion efficiency of Awassi breed (Bohra, 1984) which was passed on to the crossbred population.

The fasted preslaughter weight, empty live weight and hot carcass weight were higher in AM than M lambs (table 1) which was a reflection of their finishing weights in the experiment. The dressing yield in terms of preslaughter weight or empty live weight was however similar in the two genetic groups. The average dressing yield of the two groups in terms of preslaughter weight (49.7%) and empty live weight (54.8%) was similar to earlier reports on finisher lambs drawn from feed lot studies (Prasad et al., 1981; Nivsarkar and Acharya, 1982). Greater loin eye area in AM (10.3 cm^2) than native M (8.8 cm^2) was a reflection of their preslaughter weights. Although total edible offal weight was higher in AM than M lambs due to the difference in their preslaughter weight, in terms of empty live weight total edible offal yield was found to be similar in the two genetic groups (5.7%). Similarly the difference in inedible offal content of the two groups narrowed down on its expression in terms of empty live weight. The depot fat (Kidney and caul fat) distribution was similar in M and AM (2.2% of ELW) indicating that under an optimum feeding regimen the two genetic groups had similar depot fat accretion pattern.

The cut weights of all the standard cuts were higher ($p<0.01$) in AM than M lambs because of their higher preslaughter as well as empty live weights. However expression of these standard cuts in terms percentage of half carcass weight indicated that the cut yields were similar in the two genetic groups. The cut yield of the standard cuts amounted to 33.2, 13.3, 13.2, 23.3 and 16.6% of half carcass, respectively for leg, loin, rack, neck and shoulder and breast and foreshank (table 2). The proportion of various cuts observed in this study was similar to earlier reports on Malpura and Mutton synthetic finisher lambs (Karim and Rawat, 1997).

The dissected lean and fat and KOH bone content of leg cut were similar in the two genetic groups amounting to an average of 61.3, 8.8 and 16.3% (table 3). In the loin cut the lean content decreased (50%) with concomitant increase in

Table 2. Primal and retail cut yields of Malpura (M) and Awassi × Malpura (AM) weaner lambs

Attributes	M	AM	Average	SEM	Level of significance
Cut weight (kg)					
Leg	1.304	1.718	1.511	0.08	p<0.05
Loin	0.516	0.701	0.609	40.07	p<0.01
Rack	0.518	0.685	0.602	33.74	p<0.01
Neck and shoulder	0.945	1.201	1.073	55.95	p<0.01
Breast and foreshank	0.652	0.861	0.757	41.49	p<0.01
Total cut weight	3.935	5.166	4.551	0.24	p<0.01
Cut weight as % of half carcass					
Leg (%)	33.6	32.9	33.3	0.51	p>0.05
Loin (%)	13.0	13.6	13.3	0.33	p>0.05
Rack (%)	13.1	13.3	13.2	0.12	p>0.05
Neck and shoulder (%)	23.4	23.3	23.3	0.39	p>0.05
Breast and foreshank (%)	16.5	16.8	16.7	0.28	p>0.05

Table 3. Composition of primal cuts and the whole side of Malpura (M) and Awassi × Malpura (AM) weaner lambs

Attributes	M	AM	Average	SEM	Level of significance
Leg					
Lean (%)	60.7	62.0	61.4	2.45	p>0.05
Fat (%)	8.9	8.8	8.9	0.23	p>0.05
KOH bone (%)	18.2	14.4	16.3	3.14	p>0.05
Loin					
Lean (%)	46.3	53.5	49.9	2.14	p<0.05
Fat (%)	27.7	24.7	26.2	2.13	p>0.05
KOH bone (%)	17.1	13.5	15.3	1.98	p<0.05
Rack					
Lean (%)	43.6	50.5	47.1	2.79	p<0.01
Fat (%)	16.2	12.4	14.3	1.96	p>0.05
KOH bone (%)	27.8	24.7	26.3	2.65	p>0.05
Neck and shoulder					
Lean (%)	48.0	57.9	52.9	3.14	p<0.01
Fat (%)	14.7	15.1	14.9	1.17	p>0.05
KOH bone (%)	24.4	18.8	21.6	2.13	p<0.05
Breast and foreshank					
Lean (%)	42.9	46.5	44.7	1.73	p<0.05
Fat (%)	16.7	14.2	15.5	1.19	p>0.05
KOH bone (%)	28.7	23.6	26.2	2.13	p<0.05

fat proportion (26%). Although lean and bone contents were significantly different in the two genetic groups for rack, neck and shoulder and breast and fore shank cuts still fat content was similar for these cuts in the two groups. On an average the separable lean, fat and KOH bone content of the half carcass were 48.3, 16.8 and 23.2% for M and 54.1, 15.0 and 19.1% for AM lambs, respectively. However, the results indicated that at six months of finishing age, the M lambs had higher carcass fat content than AM lambs. Relatively higher total separable fat content of half carcass in native Malpura lambs indicated that either they were fed at a higher level than their requirement or it was a breed difference.

It is concluded that the growth rate and feed conversion efficiency were better in crossbred Awassi × Malpura than native Malpura lambs while dressing yield and cutability of standard cuts were similar in the two genetic groups. Further, at six months of age, the Malpura × Awassi lambs produced significantly more edible meat. Relatively higher separable fat content of half carcasses of the native Malpura lambs was possibly a breed difference.

ACKNOWLEDGEMENT

We are grateful to the Director of the institute for providing facilities and technical assistance rendered by Mr. M. Nasimuddin in slaughter studies is acknowledged.

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